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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,813	09/12/2003	Hemant P. Mungekar	A8067/T51700	7055

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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	**PAPER NUMBER**
1753	

DATE MAILED: 02/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/660,813	MUNGEKAR ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 4, 7, 11-15, 17, 18, 26 and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Papasouliotis et al. (U.S. Pat. 6,846,745).

Regarding claim 1, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123; Column 6 lines 42-55) Thereafter etching the first portion by flowing an etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4, SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound), and NF_3 (i.e this gas contains a halogen precursor) for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block 125; Column 8 lines 66-68; Column 9 lines 1-20) Thereafter a second portion of the film is deposited over the substrate from a

second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding Claims 1 and 26 where the halogen precursor and the hydrogen precursor being flowed into the processing chamber at respective flow rates to control chemical interaction between the halogen precursor and the hydrogen precursor to provide a desired etch rate, Papasouliotis et al. '745 teach that the flow rate of the precursors can be controlled. For example the halogen precursor gas (i.e. NF_3 or SiH_2F_2) can have a flow rate of 0 up to about 500 sccm. The hydrogen precursor gas (i.e. SiH_4) can have a flow rate of 0 to 60 sccm. The oxygen precursor gas can flow at about 10 to 1000 sccm. (Column 9 lines 1-20)

Regarding claim 3, the halogen precursor comprises a fluorine precursor. (Column 8 lines 66-68; Column 9 lines 1-20)

Regarding claim 4, the fluorine precursor can be NF3. (Column 9 line 3)

Regarding claim 7, the fluorine precursor can be SiF4. (Column 9 line 2)

Regarding claims 11, 12, during the etching a high-density plasma is maintained. (Column 9 lines 24-25)

Regarding claim 13, the etchant can include an inert sputtering agent in the form of inert carrier gas. (Column 9 line 12)

Regarding claims 14, 15, the inert carrier gases are enumerated as helium, argon, and xenon. (Column 9 line 12; Column 9 lines 47-49)

Regarding claim 17, the deposition of the film is performed by maintaining a plasma. (Column 7 lines 53-65; Fig. 1B)

Regarding claim 18, the plasma is biased toward the substrate. (Column 8 lines 27-43)

Regarding claim 26, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123; Column 6 lines 42-55) Thereafter etching the first portion by flowing an etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4, SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound)and NF_3 for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block 125; Column 8 lines 66-68; Column 9 lines 1-20) The flow rates of the gases can be controlled. (Column 9 lines 12-20) Thereafter a second portion of the film is deposited over the substrate from a second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding claim 27, the plasma can be biased toward the substrate during etching. (Column 9 lines 26-30)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. (U.S. Pat. 6,846,745) in view of Papasouliotis et al. (U.S. Pat. 6,794,290).

Papasouliotis et al. '745 is discussed above and all is as applies above. Silicate glasses are deposited. (See Papasouliotis et al. '745 discussed above) (Applies to claims 1-28)

The difference not yet discussed is where the hydrogen precursor comprises H_2 (Claims 2, 20), the substrate including silicon nitride and control of the hydrogen and NF3 is not discussed (Claims 5, 22), the fluorine precursor comprises F_2 is not

discussed (Claim 6), the hydrogen precursor and the oxygen precursor in a single compound is not discussed (Claim 8), the single compound being water is not discussed (Claim 9), the single compound being hydrogen peroxide is not discussed (Claim 10), controlling the sputter removal ratio is not discussed (Claim 16), the control of the hydrogen gas to effect the etching distribution is not discussed (Claims 19, 25) and the control of the flow of the second precursor gas to provided a different distribution within the processing chamber than the first precursor gas, thereby effecting a nonuniform etching distribution over the substrate (Claim 28).

Regarding claims 2, 20, Papasouliotis et al. '290 teach utilizing a hydrogen based etch in a dep/etch/dep process. (See Abstract) H_2 is utilized to chemically etch the deposited material. (Column 5 lines 12-16)

The motivation for utilizing H_2 as an etchant is that it allows for achieving better process control. (Column 7 lines 1-2)

Regarding claims 5, 22, Papasouliotis et al. '745 teach that the first layer can comprise silicon nitride. (Column 3 lines 19-24) The flow rate of the etching gases can be controlled. (Column 9 lines 10-19)

Regarding claim 6, Papasouliotis et al. '745 teach that the etching gases can be fluorine containing gases. (Here F2 is believed to be included in the teaching) (Column 8 lines 66-67)

Regarding claims 8-10, Papasouliotis et al. '290 teach a hydrogen-based plasma to chemically etch the substrate. (See Abstract) Here hydrogen-based is believed to

include hydrogen based chemicals such as water and hydrogen peroxide. (See Abstract)

Regarding claims 16, 28, Papasouliotis et al. '290 teach controlling the flow rate of argon to hydrogen to control the rate of sputtering and chemical etching. (Column 7 lines 7-20)

Regarding claim 19, 25, Papasouliotis et al. '290 teach controlling the flow rate of hydrogen in the chamber. (See Column 7 lines 7-20)

The motivation for controlling process gases and controlling process parameters is that it allows for achieving better control of etching rate. (Column 7 lines 1-2)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Papasouliotis et al. '745 by controlling the process gases and process parameters as taught by Papasouliotis et al. '290 because it allows for achieving better control of etching rate.

Response to Arguments

Applicant's arguments filed November 30, 2005 have been fully considered but they are not persuasive.

Applicant has amended the claims to show the control of the flow rates of the halogen precursor and the hydrogen precursor to preclude the use of providing both precursors in a single compound. However the examiner argues that Papasouliotis et al. teach that the halogen precursor (i.e containing fluorine) can include NF_3 and that the flow rate of that precursor is controlled to be 0 to about 500 sccm. The hydrogen precursor can include SiH_4 (silane) which can be controlled at a flow rate of 0 to 60

sccm. The oxygen precursor can include O_2 which can be controlled to a flow rate of 10 to 1000 sccm. Therefore the separate precursors are taught by Papasouliotis et al. '745 (See Papasouliotis et al. '745 discussed above; Column 9 lines 1-20)

In response to the argument that the teachings of the '290 patent are not combinable with the teaching of the '745 patent because the fluorine chemistry would dominate the etch process, it is argued that the claims require only that a desired etch rate be achieved by the gas chemistry. Since both the hydrogen and fluorine chemistry result in an etch rate it would be obvious to combine the references because a desired etch rate is being achieved. (See Papasouliotis et al. '745 and Papsouliotis et al. ' 290 discussed above)

In response to the argument that there is no reasonable expectation of success, it is argued that the primary reference (i.e. '745 patent) does show an explicit hydrogen precursor in the form of silane gas in combination of with a halogen precursor gas in the form of NF_3. Therefore, the process of combining a hydrogen precursor gas with a halogen precursor gas is expected to have success as shown by the '745 patent. (See Papasouliotis et al. '745 and Papsouliotis et al. ' 290 discussed above)

In response to the argument that the '290 patent teaches away from utilizing a fluorine based etch with a hydrogen based etch, it is argued that the primary reference teaches utilizing a halogen precursor (NF_3) with a hydrogen precursor (SiH_4). The secondary reference '290 teaches only a hydrogen etch instead of a fluorine etch but since the primary reference recognizes utilizing a halogen precursor with a hydrogen precursor it would be obvious to utilize a known hydrogen precursor for etching as

taught by the '290 patent because the hydrogen controls the process better. While Applicant has argued that the '290 patent utilizes a hydrogen etch instead of a fluorine etch the primary reference recognizes that a combined etch is better. (See Papasouliotis et al. '745 and Papsouliotis et al. ' 290 discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
February 8, 2006